Module 3: Facilitator instructions for Circulation Skills Station

1. Preparation
   a. Assemble equipment beforehand.
   b. Make sure that you have what you need and that it is functioning properly.

2. Equipment
   a. Manikin for selecting sites for IV placement
   b. Manikin for performing intraosseous vascular access
   c. Intraosseous needles
   d. An assortment of IV catheters, arm boards, T connectors, tape, tourniquets
   e. IV fluid bags
   f. IV infusion sets (adult and pediatric)
   g. Buretrols (if available)
   h. Job aids for calculating fluid rates

3. General principles
   a. Begin by demonstrating the equipment/skill. Each student should practice using the equipment and performing each skill.
   b. Give each student immediate, constructive feedback.
   c. You may use case scenarios to illustrate important points.

4. Record keeping: complete participant evaluation forms

5. Specific skills
   a. Skill 1: IV placement
      i. Learning objectives
         1. Identify sites for possible IV placement.
         2. Describe and demonstrate IV placement.
         3. Describe signs of IV infiltration.
      ii. Technical/teaching information
         1. Signs of infiltration
            a. Swelling at the IV site.
            b. Pain at the IV site.
            c. IV won’t flush.
b. **Skill 2: IO placement**
   
i. **Learning objectives**
   1. Identify sites for IO placement.
   2. Describe and demonstrate IO placement.
   3. Describe risks of IO placement.
   4. Describe signs of IO infiltration.

ii. **Technical/teaching information**
1. **Risks of IO placement**
   a. Infection
   b. Pain
2. **Signs of infiltration**
   a. Swelling around IO site
   b. IO needle will not flush.
3. Suggest that provider stand on the side of the patient opposite the leg that is being used for IO access.

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**Intraosseous Needle Insertion**

When carried out by a well-trained and experienced health worker, intravenous infusion is a simple and reliable method of giving fluid and drugs in an emergency. The method is safe if the needle is left in place no longer than 6-8 hours. All parenteral fluids and drugs recommended in these guidelines can be given by this route.

In an emergency this may be the first choice if access to a peripheral vein does not appear to be obtainable. It takes 1-2 minutes to establish intravenous access. The procedure is painful, but no anesthetic is required as it should only be used in an emergency (e.g., when a child is in shock).

**Contra-indications:**

- Infection at the intended puncture site
- Fracture of the bone (relative contra-indication, not for shock, only for dehydration)

The first choice for the puncture is the proximal tibia. The site for needle insertion is in anteromedial surface of the tibia, 1-2 cm below the tibial tuberosity (2 finger breadths in children, 1 finger breadth in infants). An alternative site for needle insertion is the distal femur, 2 cm above the lateral condyle.

**Prepare the necessary equipment:**

- Bone marrow aspiration or intravenous needles (15-18 gauge or, if not available, 21 gauge; if no special needles are available, large-bore (21 FG) hypodermic or butterfly needles can be used in young children)
- Antiseptic solution and sterile gauze to clean the site
- A sterile 5-ml syringe filled with normal saline
- A second sterile 5-ml syringe filled with normal saline
- IV infusion equipment
- Sterile gloves.

**Select the site for cannulation:**

- First, palpate the tibial tuberosity
- Then, locate one finger's breadth below and medial to the tuberosity (the bone can be felt under the skin at this site).

**Wash the hands and put on sterile gloves.**

**Clean the skin over and surrounding the site with an antiseptic solution.**

**Stabilize the proximal tibia with the left hand (this hand is now not sterile) by grasping the thigh and knee above and lateral to the cannulation site, with the fingers and thumb wrapped around the knee but not directly behind the insertion site.**

**Palpate the landmarks again with the sterile glove (right hand).**

**Insert the needle at a 90° angle to the bone with the bevel pointing towards the foot. Advance the needle using a gentle but firm, twisting or drilling motion.**

**Stop advancing the needle when you feel a sudden decrease in resistance. The needle should be fixed in the bone.**
c. Skill 3: Calculating bolus and maintenance fluids for well-nourished children in shock:
   i. Learning objectives
      1. Learn to accurately calculate amount of fluid for IV bolus for well-nourished children in shock.
      2. Describe the push-pull method for delivering an IV fluid bolus.
      3. Learn to accurately calculate amount and hourly drip rate for maintenance fluid for well-nourished children in shock.

   ii. Technical/teaching information
      1. Present a short scenario describing a well-nourished child who is in shock (cool hands, capillary refill >3 secs, weak pulses, altered mental status). Tell the participants how much the child weighs. Ask them to determine the following (using job aids):
         a. Amount of bolus
         b. Amount of maintenance
         c. Hourly drip rate for maintenance
      2. Present additional scenarios using children of different ages and weights.
      3. Ask them to demonstrate the push-pull method.

Estimating IV fluid bolus volume for shock by age or weight (well-nourished)

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Volume of isotonic fluid to infuse (20 mL/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 months</td>
<td>&lt;4 kg</td>
<td>75 mL</td>
</tr>
<tr>
<td>2-&lt;4 months</td>
<td>4-&lt;6 kg</td>
<td>100 mL</td>
</tr>
<tr>
<td>4-&lt;12 months</td>
<td>6-&lt;10 kg</td>
<td>150 mL</td>
</tr>
<tr>
<td>1-&lt;3 years</td>
<td>10-&lt;14 kg</td>
<td>250 mL</td>
</tr>
<tr>
<td>3-&lt;5 years</td>
<td>14-19 kg</td>
<td>350 mL</td>
</tr>
</tbody>
</table>

Maintenance IV fluid for shock by age or weight (well-nourished): total volume (volume per hour)

<table>
<thead>
<tr>
<th>Weight</th>
<th>Age &lt;12 mo (over 5 hours)</th>
<th>Age 12 mo-5yr (over 2 ½ hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 kg</td>
<td>200mL (40mL/hr)</td>
<td></td>
</tr>
<tr>
<td>4 &lt;6 kg</td>
<td>350mL (70mL/hr)</td>
<td></td>
</tr>
<tr>
<td>6-&lt;10 kg</td>
<td>550mL (110mL/hr)</td>
<td>550mL (220mL/hr)</td>
</tr>
<tr>
<td>10 &lt;14 kg</td>
<td>850mL (170mL/hr)</td>
<td>850mL (340mL/hr)</td>
</tr>
<tr>
<td>14-19 kg</td>
<td>1200mL (240mL/hr)</td>
<td>1200mL (480mL/hr)</td>
</tr>
</tbody>
</table>

Adapted from ETAT manual for participants, Chart 7, page 73

Adapted from ETAT manual for participants, Chart 11, page 77
d. Skill 4: Calculating bolus and maintenance fluids for children with severe acute malnutrition in shock
   i. Learning objectives
      1. Learn to accurately calculate amount of fluid for IV bolus (delivered with push-pull) for severely malnourished children in shock.
      2. Learn to accurately calculate amount for maintenance IV and oral fluid and hourly drip rate for severely malnourished children in shock.
      3. Identify signs of deterioration for severely malnourished children receiving IV fluid.
   ii. Technical/teaching information
      1. Present a short scenario describing a severely malnourished child who is in shock (cool hands, capillary refill >3 secs, weak pulses, decreased mental status). Tell the participants how much the child weighs. Ask them to determine the following (using job aids):
         a. Amount of bolus
         b. Amount of maintenance
         c. Hourly oral maintenance
      2. Present additional scenarios using children of different ages and weights.
      3. Ask them to describe changes in heart rate and respiratory rate for which IV infusion should be stopped. (Heart rate increases by 15 beats/min and/or respiratory rate increases by 5 breaths/minute, indicating possible heart failure)
Estimating IV fluid bolus volume by weight (severe malnutrition)

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Volume of isotonic fluid to infuse (15 mL/kg over 1 hour)</th>
<th>Weight (kg)</th>
<th>Volume of isotonic fluid to infuse (15 mL/kg over 1 hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>60 mL</td>
<td>12</td>
<td>180 mL</td>
</tr>
<tr>
<td>6</td>
<td>90 mL</td>
<td>14</td>
<td>210 mL</td>
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<tr>
<td>8</td>
<td>120 mL</td>
<td>16</td>
<td>240 mL</td>
</tr>
<tr>
<td>10</td>
<td>150 mL</td>
<td>18</td>
<td>270 mL</td>
</tr>
</tbody>
</table>

Adapted from ETAT manual for participants, Chart 8 page 74

Malnourished child, signs of shock (Cool hands, cap refill >3 sec, weak pulse, decreased mental status)

Establish vascular access

Give 15 mL/kg D5 Ringer’s lactate, D5 ½ normal saline, or D5 ½ Darrow’s over 1 hour

Monitor heart rate and respiratory rate every 5 minutes

HR and respiratory rate unchanged or decreasing

Continue infusion

As soon as child can tolerate liquids orally, switch to ReSoMal

5mL/kg ReSoMal every 30 min for 2 hours, NG or oral

HR increases by 15 beats/min and/or respiratory rate increases by 5 breaths/min (heart failure likely)

Stop IV infusion